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Line Emission from ICF Capsules - 2D Multimode RT Effects

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The yield from an Inertial Confinement Fusion (ICF) capsule can be greatly reduced by Raleigh-Taylor (RT) instabilities at the interface between the fusion fuel and the surrounding low-temperature shell. Understanding and controlling RT instabilities is one of the most important areas of research for the ICF community, so there is interest in methods for diagnosing the level of instability in a particular experiment. Experiments shot on the Nova laser have placed small amounts of argon in the hot DT fuel and titanium in the low-temperature plastic pusher. The variation of the line strengths of the two dopants can be used as an indicator of the amount of “mixing” that has occurred as a result of RT instabilities[2].

This paper reports the results of 2D Lasnex models in which many RT wavelengths were allowed to grow and interact. The line emission is calculated using Cretin, which takes temperatures and densities from a Lasnex model and uses complete linearization to treat the coupling between the atomic kinetics and atomic line transfer. The results of these detailed models are compared to 1D Lasnex models in which the effects of RT instabilities are treated by assuming they produce an atomically mixed layer. Specific points of comparison are the variation of the thermonuclear yield and atomic line strength as a function of the initial roughness of the capsule surface.

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[2] T. R. Dittrich et al., “Diagnosis of Pusher-Fuel Mix in Indirectly Driven Nova Implosions”, Phys. Rev. Lett. **73**, 2324 (1994).